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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/723,117 | 11/26/2003 | Gang Gu | 006161.P001 | 1307 |

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EXAMINER

OLSEN, KAJ K

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| ART UNIT | PAPER NUMBER |
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1753

DATE MAILED: 08/13/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|-------------------------------|---------------------------|--|
| Office Action Summary | Application No. 10/723,117 | Applicant(s) GU ET AL. | |
| | Examiner Kaj K Olsen | Art Unit 1753 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-40 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-40 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. ____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date ____ | 6) <input type="checkbox"/> Other: ____ |

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1-6, 11, 19 and 20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
3. Claims 1-6 are incomplete. In particular, they are drawn to a method for sensing specific molecules, but the claims have no step or steps drawn to actually sensing a specific molecule. In fact, it doesn't appear these claims are drawn to method of sensing anything, but rather are drawn to a method of forming a sensor. Clarification as to how these claims are meant to be interpreted is requested.
4. In claim 11, "the material" lacks antecedent basis. It would appear that claim 11 should depend from claim 10. For the purpose of applying prior art, the examiner will interpret it as such.
5. In claims 19 and 20, it is unclear how these claims can depend from claim 16. Claim 16 states that the specific molecule is H₂S. Claims 19 and 20 (which depend from 16) changed the defined specific molecule to materials other than H₂S. It would appear that claims 18 and 19 should depend from claim 18. For the purpose of applying prior art, the examiner will interpret it as such.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 1, 3, 4, 6-8, 23 and 24 are rejected under 35 U.S.C. 102(b) as being anticipated by Cui et al (Science, 293, August 2001, pp. 1289-1292).

8. Cui discloses a method and device for sensing specific molecules that comprises a nanoelement (a nanowire) with two spaced apart electrodes in contact with the nanowire. See fig. 1. With respect to one of the electrodes being “capable of functioning as a sensing element to sense the specific molecule”, this would appear to read on any electrode that provides a sufficient low Schottky barrier to allow the sensing of specific molecules (see paragraph 0008 of the instant invention). Because Cui discloses sensitivity to specific molecules such as protons, proteins and calcium (see fig. 2-4), the electrode of Cui inherently provides the specified sensing element function.

9. With respect to “treating at least one of the two electrodes” (although this would appear to be a forming step and not a sensing step (see 112 rejection above)), any means that the electrode of Cui is constructed reads on this broadly defined treating step.

10. With respect to the use of a gate electrode, see the “nanoFET” of fig. 1a and the paragraph bridging pp. 1289 and 1290.

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

12. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

13. Claims 2, 5, 10-20, 26-31, 34-36, 39 and 40 (and claims 1, 3, 4, 6-8, 23 and 24 in the alternative), are rejected under 35 U.S.C. 103(a) as being unpatentable over Cui in view of Krstic et al (Electronic Properties of Novel Materials-Molecular Nanostructures, 2000, pp. 367-370).

14. Cui set forth all the limitations of the claims, but did not particularly set forth the use of electrode materials such as palladium, gold or alloys thereof. Krstic teaches in an alternate nanoelement device that metals such as gold and palladium alloys find utility as electrodes for these nanoelements (see experimental section). These metals have been shown to minimize the contact resistance between the nanoelement and the electrode (see introduction section). It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the teaching of Krstic for the device and method of Cui because the substitution

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of one known electrode material for another requires only routine skill in the art. In addition, the particular use of Au and Pd alloys have been shown to provide low contact resistance thereby improving the sensor responsiveness.

15. With respect to the specific molecules being sensed, that is only the intended use of the apparatus and the intended use need not be given further due consideration in determining patentability. The electrodes of Krstic inherently are capable of sensing the set forth molecules.

16. With respect to the operating temperature of the device, that is only the intended use of the apparatus and the intended use need not be given further due consideration in determining patentability.

17. With respect to the material enhancing the sensitivity being a "coating", one possessing ordinary skill in the art would recognize that materials of Krstic need only be present as a coating on the final electrode in order to still provide the set forth contact resistance. Utilizing only a final coating of Au or Pd alloy would reduce the amount of expensive metals being utilized.

18. With respect to claims 1, 3, 4, 6-8, 23 and 24 in the alternative. If the electrodes of Cui are not interpreted as providing the "capable of functioning as a sensing element to sense the specific molecule" as the examiner argued above, then the materials set forth by Krstic clearly are capable of providing the set forth capability because Krstic is teaching the claimed materials of the instant invention.

19. Claims 2, 10, 21, 22, 37 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Cui or Cui in view of Krstic in further view of Issachar (USP 5,156,972).

20. Cui or Cui in view of Krstic set forth all the limitations of the claims, and Cui further disclosed the use of immobilized biotin for imparting chemical selectivity to an electrode. Cui

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did not explicitly teach immobilizing the biotin to the electrode or electrodes. Issachar teaches in an alternate sensor relying on immobilized biotin that the selectivity can also be imparted on the sensor by immobilizing species to the electrode itself. See col. 7, lines 50-56 and col. 18, lines 17-34. It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the teaching of Issachar for the method and device of Cui or Cui in view of Krstic because it known that selectivity of the sensor can also be imparted at the electrodes themselves.

21. Claims 9 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Cui or Cui in view of Krstic in further view of Kong et al (Science, January 2000, 287, pp. 622-625).

22. Cui or Cui in view of Krstic set forth all the limitations of the claims and Cui further disclosed that nanotubes are also suitable nanoelements for chemical sensing (see second paragraph of Cui). However, Cui did not explicitly disclose the use of sensor with carbon nanotubes. Kong (which Cui cited) explicitly demonstrates that sensors can also be constructed using carbon nanotubes and provide analogous sensing function. See pp. 623-624. Sensors constructed with carbon nanotubes also show sensitivity towards molecules such as NO₂ and NH₃ thereby extending utility of the sensor to other materials (see fig. 2). It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the teaching of Kong for the device of Cui (or Cui in view of Krstic) because the substitution of one known nanoelement for a similarly functioning nanoelement requires only routine skill in the art. In addition, nanotubes have demonstrated sensitivity to other molecules like NO₂ and NH₃ thereby extending sensor utility.

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23. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cui or Cui in view of Krstic in further view of Holm-Kennedy (USP 5,466,348).

24. Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cui or Cui in view of Krstic in further view of Nagata et al (USP 4,913,792).

25. Cui or Cui in view of Krstic set forth all the limitations of the claims, but did not explicitly disclose what the gate electrode was constructed of. However, both silicon (see Holm-Kennedy, col. 20, lines 30-45) and metallic (see Nagata, col. 8, lines 41-43) gate electrodes are known in the art. It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the teachings of either Holm-Kennedy or Nagata for the sensor of Cui or Cui in view of Krstic because the use of conventional gate electrode materials requires only routine skill in the art.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kaj Olsen whose telephone number is (571) 272-1344. The examiner can normally be reached on Monday through Thursday from 6:30 A.M. to 4:00 P.M. and on alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen, can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications

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may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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August 12, 2004

A handwritten signature in black ink, appearing to read 'Kaj K. Olsen', with a stylized flourish at the end.

KAJ K. OLSEN
PRIMARY EXAMINER